

Current Projects - Lakes, Ponds and Reservoirs

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An Evaluation of Nonphysical Barriers for Deterring Walleye

Reservoir fisheries present managers a unique set of challenges. One of the most obvious yet most overlooked challenges to maintaining sustainable reservoir fisheries is fish escapement. A recent evaluation of walleye emigration from Rathbun Lake, Iowa determined that the probability of a walleye escaping increased with increasing mean daily discharge through the dam. Escapement probability increased exponentially with daily discharge and doubled as discharge increased from 40 to 60 m³/s. Our results indicate a substantial proportion of the Rathbun Lake walleye population has been lost recently, due in part to record water releases from the dam, making management of this reservoir walleye fishery challenging.

The use of behavioral barriers (nonphysical), alternatives to physical barriers (such as nets or screens), have recently received considerable attention and appear to be highly successful at diverting fish. These barriers provide a negative stimulus that directs fish away from locations that may cause direct loss to fisheries. In addition to their effectiveness, nonphysical barriers do not require constant maintenance and there is no loss of dam operating efficiency caused by flow restriction. Several different types of deflection and guidance mechanisms have been employed, such as constant light, strobe lights, underwater sound, bubble curtains, and electrical barriers. However, none of these barrier technologies have been evaluated with regard to the deflection of walleye from reservoir outlets.

Iowa DNR and the Kansas City District of the Army Corps of Engineers sought to determine if strobe lights, underwater sound, and bubble curtains could be used to deter walleye. An evaluation was conducted in a test facility at Rathbun Fish Hatchery that utilized pumps to generate ~0.18 ft/sec of flow through a simulated outlet structure. A test barrier utilized three separate sound frequencies emitted by an array of underwater loudspeakers with a High Intensity Light System which can function at two levels of flash frequency. A bubble curtain was generated in front of the sound and light generators for all trials except control and light-only trials. A total of 12 trials were devised using various combinations of light and sound in tandem or singly, along with a control trial. Three repetitions of each trial were completed yielding a total of 36 trials. In each trial 28 naïve walleyes were placed above the barrier and monitored for 16 h. All fish were tagged and two antennas used to monitor fish movement through the outlet.

Results from these trials indicated that walleyes reacted similarly across all ranges of sound and light when these technologies were used in tandem and results suggest that the sound and light barriers provided no reduction in emigration probability over controls. Trials utilizing only light suggested that walleyes may be attracted to light as emigration probability rose slightly over control. All sound and bubble curtain barriers reduced emigration probabilities by approximately 50% from controls, suggesting a substantial reduction of walleye loss from reservoirs can be obtained using sound and bubble curtains.

Following completion of the first 36 trials an additional nine trials were completed to further evaluate the apparent attraction of walleyes to light. A wall was placed in the upstream section of the test facility to offer walleyes a sanctuary from the intense lights. Three repetitions of both light frequencies were tested with three control trials. Overall, light appeared to reduce emigration by 11% over control when a sanctuary was provided. These data appear contradictory to the first 36 trials in which light appeared to increase the emigration probability of test walleyes.

Overall, it appears that walleye emigration may be reduced by the utilization of a non-physical barrier. Preliminary results suggest that the most effective and cost-effective solution to this issue would be a barrier constructed of sound with a bubble curtain. The integration of light appears to provide no benefit to the overall functionality of this system, and in fact may counteract the positive effect of the sound and bubble curtain. Reductions in walleye emigration from Rathbun Lake would benefit anglers who provide substantial monetary support to the local area as well as the Iowa DNR who utilize this population as a brood source for the State's hatchery system. We suggest that the integration of a lake-based system in Rathbun Lake can provide substantial savings to the population of walleyes from both a biologic and economic standpoint.